

U.S. DEPARTMENT OF COMMERCE
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FIPS PUB 151-2

FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION
(Supersedes FIPS PUB 151-1 - 1990 March 28)

PORTABLE OPERATING SYSTEM INTERFACE (POSIX) - SYSTEM
APPLICATION PROGRAM INTERFACE [C LANGUAGE]

CATEGORY: SOFTWARE STANDARD
SUBCATEGORY: OPERATING SYSTEMS

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Computer Systems Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899
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U.S. Department of Commerce
Ronald H. Brown, Secretary

National Institute of Standards and Technology
Raymond G. Kammer, Acting Director

Foreword

The Federal Information Processing Standards Publication Series of the National Institute of Standards and Technology (NIST) is the official publication relating to standards and guidelines adopted and promulgated under the provisions of Section 111 (d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1987, Public Law 100-235. These mandates have given the Secretary of Commerce and NIST important responsibilities for improving the utilization

and management of computer and related telecommunications systems in the Federal Government. The NIST through its Computer Systems Laboratory provides leadership, technical guidance, and coordination of Government efforts in the development of standards and guidelines in these areas.

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James H. Burrows, Director
Computer Systems Laboratory

Abstract

This publication announces the adoption of International Standard ISO/IEC 9945-1:1990, Information Technology - Portable Operating System Interface (POSIX) - Part 1: System Application Program Interface (API) [C Language], as a Federal Information Processing Standard. This standard defines a C programming language source interface to an operating system environment. This standard is for use by computing professionals involved in system and application software development and implementation. This revision supersedes FIPS PUB 151-1 in its entirety.

Key words: application interface standard; applications portability; Federal Information Processing Standard (FIPS); portability; POSIX.

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Federal Information
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1993 May 12

Announcing the Standard for

PORTABLE OPERATING SYSTEM INTERFACE (POSIX)- SYSTEM APPLICATION PROGRAM INTERFACE [C LANGUAGE]

Federal Information Processing Standards Publications (FIPS PUBS) are issued by the National Institute of Standards and Technology (NIST) after approval by the Secretary of Commerce pursuant to Section 111 (d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1981, Public Law 100-235.

1. **Name of Standard.** Portable Operating System Interface (POSIX) - System Application Program Interface [C Language] (FIPS PUB 151-2).

2. **Category of Standard.** Software Standard, Operating Systems.

3. **Explanation.** This publication announces the adoption of International Standard ISO/IEC 9945-1:1990, Information Technology - Portable Operating System Interface (POSIX) - Part 1: System Application Program Interface (API) [C Language], as a Federal Information Processing Standard. This standard defines a C programming language source interface to an operating system environment. This standard is for use by computing professionals involved in system and application software development and implementation. This revision supersedes FIPS PUB 151-1 in its entirety.

4. **Approving Authority.** Secretary of Commerce.

5. **Maintenance Agency.** U.S. Department of Commerce, National Institute of Standards and Technology (Computer Systems Laboratory).

6. **Cross Index.** International Standard ISO/IEC 9945-1:1990, Information Technology-Portable Operating System Interface (POSIX) - Part 1: System Application Program Interface (API) [C Language].

7. **Related Documents.**

- a. Federal Information Resources Management Regulations subpart 201-20.303, Standards, and subpart 201-39.1002, Federal Standards.
- b. Federal Information Processing Standards Publication 160, C.
- c. ISO/IEC 9899: Information Technology-Programming Languages-C.
- d. Test Methods for Measuring Conformance to POSIX, IEEE Std 1003.3-1991.
- e. Test Methods for Measuring Conformance to POSIX.1, IEEE Std 2003.1-1992.
- f. Interpretation Procedures for Federal Information Processing Standards for Software, FIPS PUB 29-3, 1992 October 29.
- g. NVLAP Program Handbook, Computer Applications Testing POSIX Conformance Testing, NISTIR 4522, March 1991 (latest revision).
- h. NIST POSIX Testing Policy-General Information.
- i. NIST POSIX Testing Policy-Certificate of Validation Requirements for FIPS 151-2.

8. **Related On-Line Information.** Information on the NIST POSIX Testing Program is available on an electronic mail (email) file server system. Documents available are:
register-a register of accredited laboratories and tested implementations,
policy-general information on NIST POSIX testing policy,
required -information on requirements for certificates of validation under NIST POSIX testing policy for FIPS 151.

To access the system:

You must be able to send and receive email via the Internet. For most email systems, send a message to `posix@nist.gov`. When the email system responds with "Subject," you may type anything. The next line should be a basic command for the email server to send you one or more of the documents listed above. For example, to receive a copy of the register file. enter: send register.

After you issue your send command and a carriage return, the next line should signal the end of the email message as required by your email system.

Your email system may respond with EOT for the end of transmission.

The mail server program reads the message and sends the requested document to the requester's email address.

If you need help contact the Systems and Software Technology Division, B266 Technology Building, NIST. Gaithersburg, MD 20899, telephone: (301) 975-3290.

9. Objectives. The primary objectives of this FIPS are:

- a. To promote portability of useful computer application programs at the source code level.
- b. To simplify computer program documentation by the use of a standard portable system interface design.
- c. To reduce staff hours in porting computer programs to different vendor systems and architectures.
- d. To increase portability of acquired skills, resulting in reduced personnel training costs.
- e. To maximize the return on investment in generating or purchasing computer programs by insuring operating system compatibility.

10. Applicability. This FIPS shall be used for new operating systems that are either developed or acquired for Government use where POSIX-like interfaces are required. This FIPS is applicable to the entire range of computer hardware, including:

- a. laptops,
- b. micro-computer systems,
- c. mini-computer systems.
- d. engineering workstations, and
- e. mainframes.

11. Conformance. Implementations claiming conformance to FIPS 151-2 must successfully comply with the current testing requirements as defined in the "NIST POSIX Testing Policy-Certificate of Validation Requirements for FIPS 151-2."

12. Specifications. The FIPS PUB 151-2 specifications are the specifications contained in the International Standard ISO/IEC 9945-1:1990, Information Technology - Portable Operating System Interface (POSIX) - Part 1: System Application Program Interface (API) [C Language], with the modifications specified below. These modifications are required for implementations of POSIX.1 that are acquired by Federal agencies.

These modifications ensure that applications, which choose to use those optional features specified in POSIX.1 and mandated below, are strictly conforming FIPS 151-2 applications (portable to all conforming FIPS 151-2 implementations). For each modification a reference to the associated POSIX text is provided.

a. Implementations claiming conformance to FIPS 151-2 shall provide the functionality specified in FIPS 160 and provide C Standard Language-Dependent System Support. (The reference text for FIPS 160 is ISO/IEC 9899: Information Technology-Programming Languages-C) [See POSIX.1 Subclause 1.3.3–1.3.3.3 lines 143-188].

b. Implementations claiming conformance to FIPS 151-2 shall define the POSIX.1 environment variable, HOME, in the environment for the login shell. [See POSIX.1 Subclause 2.6 lines 698-699].

c. Implementations claiming conformance to FIPS 151-2 shall define the POSIX.1 environment variable, LOGNAME, in the environment for the login shell. [See POSIX.1 Subclause 2.6 lines 698-699].

d. Implementations claiming conformance to FIPS 151-2 shall support the POSIX.1 option {NGROUPS_MAX} such that the value of {NGROUPS_MAX} is greater than or equal to eight (8). [See POSIX.1 Subclause 2.8.3 lines 1013-1015].

e. Implementations claiming conformance to FIPS 151-2 shall support a minimum value of 25 for the POSIX.1 variable {CHILD_MAX}. [See POSIX.1 Subclause 2.8.4 lines 1029-1030].

f. Implementations claiming conformance to FIPS 151-2 shall support a minimum value of 20 for the POSIX.1 variable {OPEN_MAX}. [See POSIX.1 Subclause 2.8.4 lines 1031-1032].

g. Implementations claiming conformance to FIPS 151-2 shall support the functionality associated with {_POSIX_JOB_CONTROL} being defined in <unistd.h>. [See POSIX.1 Subclause 2.9.3 lines 1117-1118].

h. Implementations claiming conformance to FIPS 151-2 shall support the functionality associated with {_POSIX_SAVED_IDS} being defined in <unistd.h>. [See POSIX.1 Subclause 2.9.3 lines 1119-1120].

i. Implementations claiming conformance to FIPS 151-2 shall support the functionality associated with- {_POSIX_CHOWN_RESTRICTED} being defined in <unistd.h> with value other than -1. [See POSIX.1 Subclause 2.9.4 lines 1136-1139].

j. Implementations claiming conformance to FIPS 151-2 shall support the functionality associated with {_POSIX_NO_TRUNC} being defined in <unistd.h> with value other than -1. [See POSIX.1 Subclause 2.9.4 lines 1140-1141].

k. Implementations claiming conformance to FIPS 151-2 shall support the functionality associated with {_POSIX_VDISABLE} being defined in <unistd.h> with value other than -1. [See POSIX.1 Subclause 2.9.4 lines 1142-1144].

l. Implementations claiming conformance to FIPS 151-2 shall support the functionality associated with the setting of the group ID of a file (when it is created) to that of its parent directory. [See POSIX.1 Subclause 5.3.1.2, 5.4.1.2, and 5.4.2.2 lines 188-192, 384-385, and 431-432].

m. Implementations claiming conformance to FIPS 151-2 shall support, for terminal devices, the functionality associated with an interrupted read() such that the return from read() when interrupted by a signal after successfully reading some data

returns the number of bytes the system has read. [See POSIX.1 Subclause 6.4.1.2 lines 132-134].

n. Implementations claiming conformance to FIPS 151-2 shall support, for terminal devices, the functionality associated with an interrupted write() such that the return from write() when interrupted by a signal after successfully writing some data returns the number of bytes the system has written. [See POSIX.1 Subclause 6.4.2.2 lines 214-216].

o. Implementations claiming conformance to FIPS 151-2 shall support the functionality associated with the symbols CS7, CS8, CSTOPS, PARODD, and PARENS defined in <termios.h> for asynchronous general terminal interface devices. [See POSIX.1 Subclause 7.1.2.4 lines 383-387].

p. Implementations claiming conformance to FIPS 151-2 shall document in the POSIX Conformance Document the FIPS 151-2 conditional features implemented [See 11. for documentation details]. (The term conditional features are the features or behaviors referred to in FIPS 151-2 that need not be present on all conforming implementations. IEEE Std 2003.1-1992 lists the documentation assertions for POSIX.1).

13. Implementation. This standard becomes effective October 15, 1993. This standard is compulsory and binding for use in all solicitations and contracts for new operating systems where POSIX-like interfaces are required.

a. Acquisition of a Conforming Portable Operating System Environment. Operating system environments which are to be acquired for Federal use after the effective date of this standard and where POSIX-like interfaces are required shall use this FIPS. Conformance to this FIPS shall be considered whether the operating system environments are:

1. developed internally,
2. acquired as part of an ADP system procurement,
3. acquired by separate procurement,
4. used under an ADP leasing arrangement, or
5. specified for use in contracts for programming services.

b. Interpretation of this FIPS. NIST provides for the resolution of questions regarding the FIPS specifications and requirements, and issues official interpretations as needed. All questions about the interpretation of this FIPS should be addressed to:

Director
Computer Systems Laboratory
Attn: POSIX FIPS 151 Interpretation
National Institute of Standards and Technology
Gaithersburg, MD 20899

c. Validation of Conforming Operating Systems Environments. NIST has developed cooperatively with industry a validation suite for measuring conformance to this standard. This suite is required for testing conformance of POSIX.1 implementations to FIPS 151-2. The "NIST POSIX Testing Policy-General Information" and the "NIST

POSIX Testing Policy - Certificate of Validation Requirements for FIPS 151-2" specify the validation requirements.

14. **Waivers.** Under certain exceptional circumstances, the heads of Federal departments and agencies may approve waivers to Federal Information Processing Standards (FIPS). The head of such agency may redelegate such authority only to a senior official designated pursuant to section 3506(b) of Title 44, U.S. Code. Waivers shall be granted only when:

a. Compliance with a standard would adversely affect the accomplishment of the mission of an operator of a Federal computer system, or

b. Cause a major adverse financial impact on the operator which is not offset by Governmentwide savings.

Agency heads may act upon a written waiver request containing the information detailed above. Agency heads may also act without a written waiver request when they determine that conditions for meeting the standard cannot be met. Agency heads may approve waivers only by a written decision which explains the basis on which the agency head made the required finding(s). A copy of each such decision, with procurement sensitive or classified portions clearly identified, shall be sent to: National Institute of Standards and Technology; ATTN: FIPS Waiver Decisions, Technology Building, Room B-154; Gaithersburg, MD 20899.

In addition, notice of each waiver granted and each delegation of authority to approve waivers shall be sent promptly to the Committee on Government Operations of the House of Representatives and the Committee on Governmental Affairs of the Senate and shall be published promptly in the Federal Register.

When the determination on a waiver applies to the procurement of equipment and/or services, a notice of the waiver determination must be published in the Commerce Business Daily as a part of the notice of solicitation for offers of an acquisition or, if the waiver determination is made after that notice is published, by amendment to such notice.

A copy of the waiver, any supporting documents, the document approving the waiver and any supporting and accompanying documents, with such deletions as the agency is authorized and decides to make under 5 U.S.C. Sec. 552(b), shall be part of the procurement documentation and retained by the agency .

15. **Where to Obtain Copies.** Copies of this publication are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. (Sale of the included specifications document is by arrangement with the Institute of Electrical and Electronics Engineers, Incorporated.) When ordering, refer to Federal Information Processing Standards Publication 151-2 (FIPSPUB151-2), and title. Payment may be made by check, money order, or deposit account.

APPENDIX A

Application Portability Profile

FIPS 151-2 is the first component of a series of specifications needed for an applications portability profile. POSIX.1 provided the crucial first step by providing a vendor independent interface specification between an application program and an

operating system. When fully extended, POSIX will provide the functionality required to support source code portability for a wide range of applications across many different machines and operating systems.

NIST has published Special Publication 500-187, Application Portability Profile (APP), The U.S. Government's Open System Environment Profile, OSE/1, Version 1.0. The APP has been developed to provide sufficient functionality to accommodate a broad range of application requirements. The functional components of the APP constitute a framework for organizing standard elements that can be used to develop and maintain portable applications. A key aspect of the APP is that it is based on an open system environment defined by non-proprietary specifications. Components may be added or deleted as technology changes and as Federal government requirements change.